



Modular Transmitters – Guidance for Host Manufacturers and Soft Configurations

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Certified Transmitter Modules (Modules)

- Module Review for Grantee
 - Importance of OEM instructions
 - Host dependency
- Guidance for Host Manufactures
 - Basics for using modules
 - Steps to take for ensuring regulatory compliance:
 - Single & multiple modules transmitting simultaneously
 - EMC Requirements & Total power requirements
 - RF Exposure
 - Approval Procedures



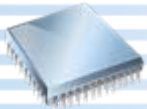
OEM Instructions

§ 15.212 (vii) ...**provide adequate instructions along with the module to explain any such requirements.** A copy of these instructions must be included in the application for equipment authorization.

- Regulatory rules covered by the module
- Other general regulatory requirements
 - RF safety requirement conditions
- Define all conditional module use requirements
- Host platform requirement and dependencies(i.e. software or hardware control of RF) that is applicable
- Conditions for Co-location of other transmitters and Simultaneous transmission conditions.
- Antennas that must be used (licensed and unlicensed)
- Information and labeling requirements for final Host & end User disclosures.
- Restrictions on modification



Host Dependent – Limited Conditions



Host Dependency (limited)		Host Needed for
A	Particular (Specific) host	Only granted in specific Host: <ul style="list-style-type: none">•RF Exposure•HAC
B	Host platform type provides additional hardware capabilities for proper module operation	Only granted in host that demonstrates having additional: Shielding amplitude buffered inputs power regulation, antenna calibration
C	Host integrator and Module grantee have shared responsibility for Compliance	Host involved/controls/sets frequency, power, modulation, operating condition, regulatory domain.





Host Dependent – Limited Conditions

(A) Limited to Particular Host

● Compliance with RF exposure/HAC rules can only be demonstrated for particular product configurations. Certification must be tested in the particular host.

(B) Limited to Host Platform Types

● Compliance is ensured when integrated in hosts that provide similar capabilities

- Authorization application must clearly include the conditions the host must provide: e.g., shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation, antenna locations, software configurations.
- OEM instructions must clearly list conditions
 - Grantee may also retain design control



Host Dependent – Limited Conditions

(C) Modules that use or require the host based configurations

- Configurations set through host
- Examples include controller chip, or any other parameter to set frequency, power, modulation or operating condition to operate as granted is a host shared dependent module
 - For other software options later discussions
- Limited by joint responsibility - options
 - Split modular or similar in certification procedure.
 - Host and module require an authentication/security method defined in the application, grant conditions and OEM Instructions.
 - Not accessible and changeable by any third parties (Similar/or SDR).
 - Contractual joint responsibilities agreement
 - Under PBA



Guidance for Host Manufactures

- Host Manufactures using a module(s) are responsible for compliance to all the rules that apply to the product.-
 - No different than a product not using modules.
- The advantages of a module are: reduction in (1) testing and/or (2) certification procedure(s).
- Regulatory compliance required for general conditions of operation, licensing, marketing, importation, labeling, identification and information to users.
- Most modules are not certified to operate with other modules
 - No Collocation conditions may be applicable (TCBs must use this condition if really necessary)
 - Additional testing and certification may be necessary when multiple modules are used
 - OEM instructions must make this clear



Host Integrator Considerations

- Steps to be considered by Host Integrator
 - Identify all rules applicable for the host product
 - Determine the areas covered by the module grants and identify additional regulatory issues to be addressed
 - Case 1 – The integrated host complies with all rules and no new submission necessary to the FCC
 - Case 2 – Additional compliance information to be submitted to the FCC



Host Integrator – EMC Considerations

● EMC Consideration

- §§ 15.31, 2.1041, 2.1091, 2.1092 requirements must be satisfied
 - Demonstrate that the final host product is compliant with all transmitters operating simultaneously, if applicable.
- Host Manufacture can use reasonable engineering judgment & testing following the requirements of §15.31 and procedures outlined for verification (§§ 2.953 and 2.948)
- Out-of-band, restricted band and spurious requirements for single and/or simultaneous operation must be considered



Host Integrator – EMC Considerations

- In Band Power Limit for Simultaneous (Multiple Modules) when used in the same band (KDB 662911 applies)
 - A set of modules used in the same band transmitting simultaneously, each individual module (transmitters) must comply with its specific requirement. The total power contribution from all modules (transmitters) can not exceed the power level permitted in that band for the operation type (point to multipoint, point to point, Omni directional)
 - For example:
 - One < 75 FHS (.125 W limit) 2.4 GHz module Plus 1 DTS (1 W limit) 2.4 GHz module , non pt.-to-pt., the total power of both modules would be limited to 1 watt or .125 mw FHS module Plus .750 w DTS module
 - Four - DTS (1 W Limit.) 2.4 GHz modules, 4 separate 6dBi antennas non overlapping beams antenna would be limited to 1 w per module. 15/247 (c) (2) smart antenna rules
 - Four- DTS/UNII (1 W/ea. Limit) 5725-5825 modules, pt.-to-pt., would also be limited to 1 watt or 250 mw per module



Host Integrator – RF Exposure Considerations

● RF Exposure Evaluations

- Must review applicable KDB General and Host Guidance (Applicable procedures)
- Multiple Modules transmitting Simultaneously
 - The grant note “not to be co-located with any other transmitters except in accordance with the FCC multi-transmitter product procedures” means that the module can not be co-located without further evaluation/certification.
 - Host manufacture may have to perform additional tests to demonstrate compliance in all modes



Case 1 – No FCC Submission Required

- If the Host Integrator determines after all the evaluations that the host will continue to comply under all conditions, no submission is necessary to the FCC
- Manufacturer must maintain records of the final tests as per requirements of Section 2.953 and 2.948 as a guide. FCC may request to inspect the records



Case 2 – FCC Submission Required

- If the Host manufacture determines that the compliance information provided for each of the module is not sufficient to cover the host conditions, additional information must be provided to FCC.
 - Require updating EMC compliance for the modules through power management
 - Require additional RF Exposure information
 - Require Host use condition limitations for compliance – like indoor operation or master control
- Additional Certification Options must be used.



Additional Certification Options

- Module Grantee files a permissive change or a change in ID (module grantee code) to address additional requirements.
 - In case of multiple modules one module grantee files (use one main module as a non certified sub-assembly)
 - Use one module to establish a certification record:
 - it is permissible to upload relevant test reports.
 - Additional test reports can be provided to demonstrate full compliance
 - Have written permission from the original grantee.

- Host integrator requests a new ID for one module
 - Have written permission from the original grantee.
 - Additional test reports can be provided to demonstrate full compliance

- Host integrator requests a new FCC ID (all modules treated as non certified sub-assemblies)
 - Permissible to upload original relevant test reports from module grants
 - Have written permission from the original grantee(s).
 - Additional test reports to be provided to demonstrate full compliance

- Details in Question 1 of KDB996369



Considerations of “Soft” Configurations or Configurations of “non-Software Defined Radios”



RF Control Configurations

- “Hard” Configurations:
 - All frequency determining circuits including power, modulation, tuning etc. fixed in the hardware design without user configuration control (limited control to adjust power for installation and gain)
- “Soft” Configurations:
 - Some frequency determining parameters configured through non-hardware means; such parameters may include power tables, antenna calibration, frequency options based on location, sensor based control, country of operation based configurations, etc.



“Soft” Configuration – Why?

- Permit design flexibility for a range of products
- Allow same base design to be used in multiple configurations
 - Adjust for variation of different regulatory requirements
 - Permit product evolution
- Adjust for product manufacturing process and component variations



“Soft” Configurations – How?

- Many different approaches are possible, for example some combinations of the following may be used:
 - ROM based configurations
 - EEPROM (with or without field programmability) with or without unique hardware tokens for specific categories
 - Sensor based (proximity, location, etc.)
 - Boot-load and / or BIOS based configuration
 - Software Driver based (authenticated or system controlled)
 - Network or system management based (local or through network connection)
 - External Database
 - Over-the-air software uploads
 - Service provider based
 - User interface based



Compliance Considerations

- Grantee is required to ensure compliance of the approved device under all operating conditions and modes
- Many rule parts place special conditions on user access to operating parameters, for example:
 - Part 15 restrictions on user programming and access (§ 15.15)
 - Part 15 restrictions on master and client devices (§ 15.202)
 - Part 90 front panel programming restrictions (§§ 90.203(g) and 90.427 (b))
 - Part 95 restrictions (§§ 95.645 and 95.655)



Compliance Approaches

- Grantee maintains complete control of how the parameters are configured and does not allow third party (users, installers, integrators, service centers, etc.) access to set or adjust parameters
 - *Operational description must be clear if such configurations are part of the design and how control is maintained (TCB must ask for this and review it)*
 - No user controllable or configurable software or network based software is provided
 - Alternative is to consider Software defined radio approvals



Modular Certifications

- Grantee must ensure all the configurations that determine compliance are part of the module and the operation description makes it clear in the filing
- If the grantee (or through licensed third party) uses software or other host based means to configure the module for compliance:
 - This must be clearly described in the operational description
 - Modules cannot be programmed through country code or other control settings unless approved by FCC (by PBA)
 - Software to control duty cycle for compliance must be clearly described and approved – with very specific OEM instructions and approval; duty cycle range must be fixed in the software to ensure compliance
 - The Host integrator shares responsibilities in compliance
 - OEM integration documentation must make the information clear
 - Host may require its own approval



“Soft” Configurations - Alternatives

- Software Defined Radio (SDR) Approach
 - It may be appropriate to get approval as SDR to demonstrate compliance using different configuration approaches
- Split-Module with or without Limited conditions
 - For modules, where functions are shared between modules and host, it may be possible to split certain control functions
 - Appropriate authentication and validation approaches must be approved by FCC



Non-SDR Special Cases

- Under certain circumstances grantee may be permitted to perform “over-the-air” software upgrades or allow approved parties to perform the functions (KDB 178919)
- Other special arrangements may be considered on a case-by-case basis
- TCB must ensure that any special cases are pre-approved by FCC



Part 15 – Special Cases

- Certain Part 15 devices may have the ability to operate outside the authorized band:
 - This is only permitted for client devices as described in § 15.202.
 - Clients must be truly passive and must wait for an “enabling” signal which permits transmission on that frequency.
 - This is not a “country code” setting
 - Master must not transmit on non-US frequency
 - Operational description must include how the master is prohibited from transmitting in such frequencies
 - For devices that act as “master” in some bands and “client” in other bands the description must explain how this is achieved and managed



Compliance for other modes

- In some cases compliance may be achieved under the guidance of authorized master:
 - Devices may support Wi-Fi Direct in bands where an authorized master (for example with DFS and radar detection capability in the UNII band) is operating.
 - In this case the devices must operate on the same frequency as the master and must move when the master initiates a move



Compliance for other modes

● Indoor operation compliance

- In the bands requiring indoor operation, the device must be programmed to detect indoor operation, or
 - Device must be connected to AC Power(*), or
 - Device must be under the control of a local master that is acting as an access point and is connected to AC Power(*)
 - Normal “hot spot” in portable devices are not acceptable
 - Remote connection over to network service provider are not acceptable
 - (*) AC Power means “mains” and not through portable DC inverters



Device Configurations through Country Code

- Device Configurations through Country Code are not permitted for compliance purposes when codes are not directly programmed in the hardware,
- Following configurations generally not permitted for non-SDR without prior approval
 - Modular transmitters programmed through host interface for country code compliance unless Host is also certified for compliance
 - Mobile Country Codes (MCC) or Mobile Network Codes (MNC) are not acceptable for programming host compliance
 - Country codes entered through other interfaces provided to users, network, device driver etc must not be used to rely on compliance



Extended Frequency Operation

- Devices with “extended frequency” operation approved on grant listing must not rely on user configurations
 - Operation description must clearly show how the control is maintained in US for compliance
- Where frequency operation is permitted under multiple rule parts with software configuration
 - Operational description must explain how control is maintained and compliance assured for each rule part



User Control Restrictions

- Devices subject to user programming restrictions like front panel programming or frequency programming and using software for configuration:
 - Operation description and user manual instructions must be included to show how compliance is assured
 - Any software or service center control capabilities must be described



Comments on Proposal

- Propose to modify KDB Publication:
 - KDB 594280 (Software Configuration Control)
 - KDB 996369 (Modular Transmitter Guide)
 - Include some of the discussions in this presentation and plan for further guidance
- Draft KDB publications will be created to invite comments prior to modification of the current versions. We invite comments on:
 - Proposed clarifications
 - Areas that need to be further addressed
 - Questions or concerns on the proposals
 - Other comments



Questions and Answers

Thanks!